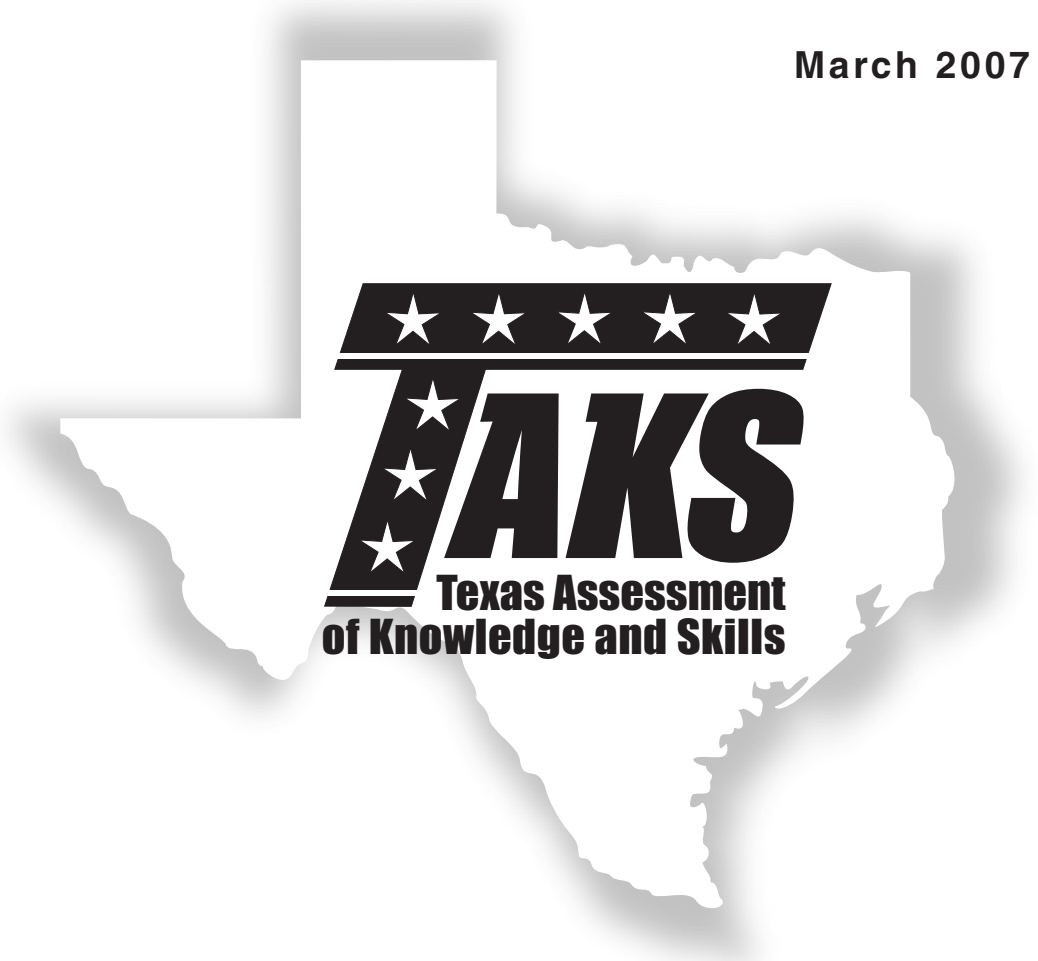
March 2007



Information Booklet

MATHEMATICS

Exit Level

Revised Based on TEKS Refinements

Texas Education Agency • Student Assessment Division

INTRODUCTION

The Texas Assessment of Knowledge and Skills (TAKS) is a completely reconceived testing program. It assesses more of the Texas Essential Knowledge and Skills (TEKS) than the Texas Assessment of Academic Skills (TAAS) did and asks questions in more authentic ways. TAKS has been developed to better reflect good instructional practice and more accurately measure student learning. We hope that every teacher will see the connection between what we test on this state assessment and what our students should know and be able to do to be academically successful. To provide you with a better understanding of TAKS and its connection to the TEKS and to classroom teaching, the Texas Education Agency (TEA) has developed this newly revised version of the TAKS information booklet based on the TEKS refinements. The information booklets were originally published in January 2002, before the first TAKS field test. After several years of field tests and live administrations, the information booklets were revised in August 2004 to provide an even more comprehensive picture of the testing program. Since that time the TEKS for secondary mathematics have been refined. These TEKS refinements were approved by the State Board of Education in February 2005. In December 2005, the Student Assessment Division produced an online survey to obtain input as to whether the new TEKS content should be eligible for assessment on TAKS mathematics tests at grades 6–10 and exit level. The results of the survey from 1,487 groups composed of 17,221 individuals were compiled and analyzed. Then the TEA math team from the Curriculum and Student Assessment Divisions, with input from educational service center math specialists, used the survey data to guide decisions on what new content should be assessed on the secondary TAKS math tests. This new content, as well as the original content, can be found in this newly revised information booklet. We hope this revised version of the TAKS information booklet will serve as a user-friendly resource to help you understand that the best preparation for TAKS is a coherent, TEKS-based instructional program that provides the level of support necessary for all students to reach their academic potential.

BACKGROUND INFORMATION

The development of the TAKS program included extensive public scrutiny and input from Texas teachers, administrators, parents, members of the business community, professional education organizations, faculty and staff at Texas colleges and universities, and national content-area experts. The agency involved as many stakeholders as possible because we believed that the development of TAKS was a responsibility that had to be shared if this assessment was to be an equitable and accurate measure of learning for all Texas public school students.

The three-year test-development process, which began in summer 1999, included a series of carefully conceived activities. First, committees of Texas educators identified those TEKS student expectations for each grade and subject area assessed that should be tested on a statewide assessment. Then a committee of TEA Student Assessment and Curriculum staff incorporated these selected TEKS student expectations, along with draft objectives for each subject area, into exit level surveys. These surveys were sent to Texas educators at the middle school and secondary levels for their review. Based on input we received from more than 27,000 survey responses, we developed a second draft of the objectives and TEKS student expectations. In addition, we used this input during the development of draft objectives and student expectations for grades 3 through 10 to ensure that the TAKS program, like the TEKS curriculum, would be vertically aligned. This vertical alignment was a critical step in ensuring that the TAKS tests would become more rigorous as students moved from grade to grade.

For example, the fifth grade tests would be more rigorous than the fourth grade tests, which would be more rigorous than the third grade tests. Texas educators felt that this increase in rigor from grade to grade was both appropriate and logical since each subject-area test was closely aligned to the TEKS curriculum at that grade level.

In fall 2000 TEA distributed the second draft of the objectives and TEKS student expectations for eleventh grade exit level and the first draft of the objectives and student expectations for grades 3 through 10 for review at the campus level. These documents were also posted on the Student Assessment Division's website to encourage input from the public. Each draft document focused on two central issues: first, whether the objectives included in the draft were essential to measure on a statewide assessment; and, second, whether students would have received enough instruction on the TEKS student expectations included under each objective to be adequately prepared to demonstrate mastery of that objective in the spring of the school year. We received more than 57,000 campus-consensus survey responses. We used these responses, along with feedback from national experts, to finalize the TAKS objectives and student expectations. Because the state assessment was necessarily limited to a "snapshot" of student performance, broad-based input was important to ensure that TAKS assessed the parts of the TEKS curriculum most critical to students' academic learning and progress.

In the thorough test-development process that we use for the TAKS program, we rely on educator input to develop items that are appropriate and valid measures of the objectives and TEKS student expectations the items are designed to assess. This input includes an annual educator review and revision of all proposed test items before field-testing and a second annual educator review of data and items after field-testing. In addition, each year panels of recognized experts in the fields of English language arts (ELA), mathematics, science, and social studies meet in Austin to critically review the content of each of the high school level TAKS assessments to be administered that year. This critical review is referred to as a content validation review and is one of the final activities in a series of quality-control steps designed to ensure that each high school test is of the highest quality possible. A content validation review is considered necessary at the high school grades (9, 10, and exit level) because of the advanced level of content being assessed.

ORGANIZATION OF THE TAKS TESTS

TAKS is divided into test objectives. It is important to remember that the objective statements are not found in the TEKS curriculum. Rather, the objectives are "umbrella statements" that serve as headings under which student expectations from the TEKS can be meaningfully grouped. Objectives are broad statements that "break up" knowledge and skills to be tested into meaningful subsets around which a test can be organized into reporting units. These reporting units help campuses, districts, parents, and the general public understand the performance of our students and schools. Test objectives are not intended to be "translations" or "rewordings" of the TEKS. Instead, the objectives are designed to be identical across grade levels rather than grade specific. Generally, the objectives are the same for third grade through eighth grade (an elementary/middle school system) and for ninth grade through exit level (a high school system). In addition, certain TEKS student expectations may logically be grouped under more than one test objective; however, it is important for you to understand that this is not meaningless repetition—sometimes the organization of the objectives requires such groupings. For example, on the TAKS writing tests for fourth and seventh grades, some of the same student expectations addressing the conventions of standard English usage are listed

under both Objective 2 and Objective 6. In this case, the expectations listed under Objective 2 are assessed through the overall strength of a student's use of language conventions on the written composition portion of the test; these same expectations under Objective 6 are assessed through multiple-choice items attached to a series of revising and editing passages.

ORGANIZATION OF THE INFORMATION BOOKLETS

The purpose of the information booklets is to help Texas educators, students, parents, and other stakeholders understand more about the TAKS tests. These booklets are not intended to replace the teaching of the TEKS curriculum, provide the basis for the isolated teaching of skills in the form of narrow test preparation, or serve as the single information source about every aspect of the TAKS program. However, we believe that the booklets provide helpful explanations as well as show enough sample items, reading and writing selections, and prompts to give educators a good sense of the assessment.

Each grade within a subject area is presented as a separate booklet. However, it is still important that teachers review the information booklets for the grades both above and below the grade they teach. For example, eighth grade mathematics teachers who review the seventh grade information booklet as well as the ninth grade information booklet are able to develop a broader perspective of the mathematics assessment than if they study only the eighth grade information booklet.

The information booklets for each subject area contain some information unique to that subject. For example, the mathematics chart that students use on TAKS is included for each grade at which mathematics is assessed. However, all booklets include the following information, which we consider critical for every subject-area TAKS test:

- an overview of the subject within the context of TAKS
- a blueprint of the test—the number of items under each objective and the number of items on the test as a whole
- information that clarifies how to read the TEKS
- the reasons each objective and its TEKS student expectations are critical to student learning and success
- the objectives and TEKS student expectations that are included on TAKS
- additional information about each objective that helps educators understand how it is assessed on TAKS
- sample items that show some of the ways objectives are assessed

TAKS MATHEMATICS INFORMATION BOOKLET GENERAL INTRODUCTION

Learning mathematics is essential to finding answers to real-life questions. The study of mathematics helps students think logically, solve problems, and understand spatial relationships. The concepts learned in mathematics courses help students communicate clearly and use logical reasoning to make sense of their world. TEKS instruction in mathematics throughout elementary, middle, and high school will build the foundation necessary for students to succeed in advanced math and science courses and later in their careers.

The mathematics concepts of algebra and geometry are important for life outside the classroom. The six strands identified in the mathematics curriculum for kindergarten through eighth grade contain the foundation skills necessary for high school mathematics courses. In third through eighth grade, the six TAKS assessment objectives are closely aligned with the six strands identified in the TEKS curriculum. For example, in third through eighth grade mathematics Objective 1, students are to "demonstrate an understanding of numbers, operations, and quantitative reasoning"; in the TEKS curriculum the first strand identified is "number, operation, and quantitative reasoning." In ninth, tenth, and eleventh grades, students take specific math courses, including Algebra I and Geometry, rather than grade-level math courses. For the TAKS high school mathematics assessments, there are ten objectives. At these grade levels, Objectives 1–5 contain student expectations from the Algebra I curriculum. Objectives 6–8 are composed of knowledge and skills from the geometry and measurement strands of the curriculum. Objective 9 consists of percents, proportional relationships, probability, and statistics. The final objective, Objective 10, pertains to students' understanding of mathematical processes. For the grade 9, grade 10, and exit level in TAKS mathematics Objective 1, students are asked to "describe functional relationships in a variety of ways"; in the TEKS curriculum the first strand of Algebra I is identified as "foundations for functions." This close alignment reflects the important link between TAKS and the TEKS curriculum. In fact, the TAKS mathematics tests are based on those TEKS student expectations Texas educators have identified as the most critical to student achievement and progress in mathematics.

Because the high school TEKS are based on courses and because there is no state-mandated course sequence, some of the high school TAKS mathematics objectives contain student expectations from eighth grade. This was done so that students would have an opportunity to learn the concepts before being tested on them. For example, no student expectations from the Geometry curriculum are included in the TAKS objectives until the exit level test because it is not certain that every Texas student would be exposed to these concepts before the eleventh grade. For the ninth and tenth grade assessments, only those eighth grade student expectations that closely align with the Geometry TEKS will be tested. Close inspection should reveal a natural progression as students advance from the eighth grade to the exit level assessment.

The TEKS were developed to provide educators with instructional goals at each grade level. Although some student expectations are not tested, they are nonetheless critical for student understanding and must be included in classroom instruction. For each strand of learning, the mathematics TEKS provide more rigorous expectations as students master skills and progress through the curriculum. It is important for educators to vertically align their instructional programs to reinforce the unifying strands of learning each year through grade-level-appropriate instruction. To understand how student learning progresses, educators are encouraged to become familiar with the curriculum at all grade levels. Educators may find it helpful to examine sample items at each grade level to gain a greater understanding of what students need to know and be able to do in mathematics as they move from grade to grade.

A system of support has been designed to ensure that all students master the TEKS. The Student Success Initiative (SSI) requires that students meet the standard on TAKS to be eligible for promotion to the next grade level as specified below:

- the reading test at grade 3, beginning in the 2002–2003 school year;
- the reading and mathematics tests at grade 5, beginning in the 2004–2005 school year; and
- the reading and mathematics tests at grade 8, beginning in the 2007–2008 school year.

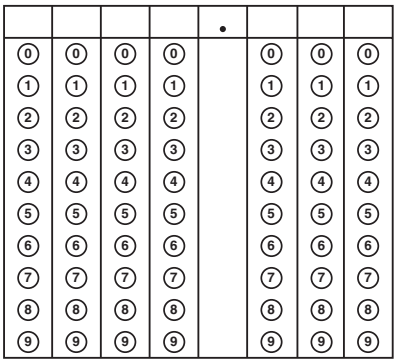
To prepare students for the SSI requirements and to promote vertical alignment, it is essential that teachers collaborate and coordinate across grade levels.

TAKS MATHEMATICS
INFORMATION BOOKLET
EXIT LEVEL

The exit level mathematics TAKS Objectives and TEKS Student Expectations describe what students should know and be able to do in order to meet graduation requirements. Teachers need to be aware of the "big picture"—an understanding of the TEKS curriculum for the lower grades, Algebra I, and Geometry. Awareness of this curriculum will enable teachers to more effectively help their students develop mathematics knowledge and skills.

TEST FORMAT

- The exit level test includes a test booklet and a separate machine-scorable answer document. Enough room is left around each item in the booklet for students to work each problem. However, student responses must be recorded on the separate answer document.
- Any item may include application context and extraneous information.
- Most items will be in a multiple-choice format with four answer choices.
- *Not here* or a variation of this phrase may be used as the fourth answer choice when appropriate.
- There will be a limited number of open-ended griddable items. For these items an eight-column grid (with one column designated as a fixed decimal point) will be provided on the answer document for students to record and bubble in their answers. Digits must be in the correct column(s) with respect to the fixed decimal point. This griddable format is intended to allow students to work a problem and determine the correct answer without being influenced by answer choices. An example of a blank grid is shown below.



MATHEMATICS CHART

- For exit level the Mathematics Chart found on pages 9 and 10 will have measurement conversions and formulas.
- A metric ruler and a customary ruler will be provided on the separate Mathematics Chart.
- Items that require students to measure with a ruler from the Mathematics Chart may be found in any objective as appropriate.

GRAPHING CALCULATORS

- Districts must ensure that each student has a graphing calculator during the entire administration of the mathematics test.
- Any graphing calculator may be used except one with a typewriter-style keypad (known as QWERTY) or one that includes a computer algebra system (CAS). Handheld minicomputers, personal digital assistants, or laptop computers may not be used.
- All types of memory, including standard memory, ROM, RAM, and Flash ROM, must be cleared to factory default both before and after testing. In addition, any programs or applications must be removed or disabled prior to testing.
- For specific assistance in effectively preparing calculators for use during testing, please contact the calculator manufacturer.

Texas Assessment of Knowledge and Skills (TAKS)
Blueprint for Exit Level Mathematics

TAKS Objectives	Number of Items
Objective 1: Functional Relationships	5
Objective 2: Properties and Attributes of Functions	5
Objective 3: Linear Functions	5
Objective 4: Linear Equations and Inequalities	5
Objective 5: Quadratic and Other Nonlinear Functions	5
Objective 6: Geometric Relationships and Spatial Reasoning	7
Objective 7: 2-D and 3-D Representations	7
Objective 8: Measurement	7
Objective 9: Percents, Proportions, Probability, and Statistics	5
Objective 10: Mathematical Processes and Tools	9
Total number of items	**60**

Grades 9, 10, and Exit Level Mathematics Chart

LENGTH

Metric	Customary
1 kilometer = 1000 meters	1 mile = 1760 yards
1 meter = 100 centimeters	1 mile = 5280 feet
1 centimeter = 10 millimeters	1 yard = 3 feet
	1 foot = 12 inches

CAPACITY AND VOLUME

Metric	Customary
1 liter = 1000 milliliters	1 gallon = 4 quarts
	1 gallon = 128 fluid ounces
	1 quart = 2 pints
	1 pint = 2 cups
	1 cup = 8 fluid ounces

MASS AND WEIGHT

Metric	Customary
1 kilogram = 1000 grams	1 ton = 2000 pounds
1 gram = 1000 milligrams	1 pound = 16 ounces

TIME

1 year = 365 days

1 year = 12 months

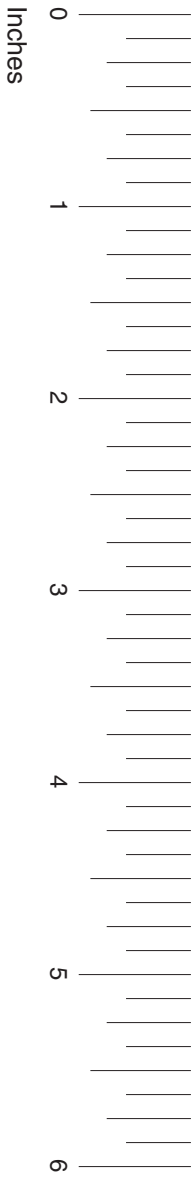
1 year = 52 weeks

1 week = 7 days

1 day = 24 hours

1 hour = 60 minutes

1 minute = 60 seconds



Grades 9, 10, and Exit Level Mathematics Chart

Perimeter	rectangle	$P = 2l + 2w$ or $P = 2(l + w)$
Circumference	circle	$C = 2\pi r$ or $C = \pi d$
Area	rectangle	$A = lw$ or $A = bh$
	triangle	$A = \frac{1}{2}bh$ or $A = \frac{bh}{2}$
	trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$ or $A = \frac{(b_1 + b_2)h}{2}$
	regular polygon	$A = \frac{1}{2}aP$
	circle	$A = \pi r^2$
P represents the Perimeter of the Base of a three-dimensional figure.		
B represents the Area of the Base of a three-dimensional figure.		
Surface Area	cube (total)	$S = 6s^2$
	prism (lateral)	$S = Ph$
	prism (total)	$S = Ph + 2B$
	pyramid (lateral)	$S = \frac{1}{2}Pl$
	pyramid (total)	$S = \frac{1}{2}Pl + B$
	cylinder (lateral)	$S = 2\pi rh$
	cylinder (total)	$S = 2\pi rh + 2\pi r^2$ or $S = 2\pi r(h + r)$
	cone (lateral)	$S = \pi rl$
	cone (total)	$S = \pi rl + \pi r^2$ or $S = \pi r(l + r)$
	sphere	$S = 4\pi r^2$
Volume	prism or cylinder	$V = Bh$
	pyramid or cone	$V = \frac{1}{3}Bh$
	sphere	$V = \frac{4}{3}\pi r^3$
Special Right Triangles	30°, 60°, 90°	$x,\ x\sqrt{3},\ 2x$
	45°, 45°, 90°	$x,\ x,\ x\sqrt{2}$
Pythagorean Theorem		$a^2 + b^2 = c^2$
Distance Formula		$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Slope of a Line		$m = \frac{y_2 - y_1}{x_2 - x_1}$
Midpoint Formula		$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
Quadratic Formula		$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Slope-Intercept Form of an Equation		$y = mx + b$
Point-Slope Form of an Equation		$y - y_1 = m(x - x_1)$
Standard Form of an Equation		$Ax + By = C$
Simple Interest Formula		$I = prt$

A Key to Understanding the TEKS Included on TAKS

Example from Objective 2

A

(A.2) **Foundations for functions.** The student uses the properties and attributes of functions. The student is expected to

B → (C) interpret situations in terms of given graphs [or create situations that fit given graphs].

C

Example from Objective 9

(8.13) **Probability and statistics.** The student evaluates predictions and conclusions based on statistical data. The student is expected to

(B) recognize misuses of graphical or numerical information and evaluate predictions and conclusions based on data analysis.

KEY

A. Knowledge and Skills Statement

This broad statement describes what students should know and be able to do. For the eighth grade curriculum, the number preceding the statement identifies the instructional level and the number of the knowledge and skills statement. For the Algebra I and Geometry curriculum, the *A* or *G* preceding the statement identifies the course, and the number identifies the knowledge and skills statement.

B. Student Expectation

This specific statement describes what students should be able to do to demonstrate proficiency in what is described in the knowledge and skills statement. Students will be tested on skills outlined in the student expectation statement.

C. [bracketed text]

Although the entire student expectation has been provided for reference, text in brackets indicates that this portion of the student expectation will not specifically be tested on TAKS.

NOTE: The full TEKS curriculum can be found at http://www.tea.state.tx.us/teks/.

TEKS STUDENT EXPECTATIONS—IMPORTANT VOCABULARY

For every subject area and grade level, two terms—*such as* and *including*—are used to help make the TEKS student expectations more concrete for teachers. However, these terms function in different ways. To help you understand the effect each of the terms has on specific student expectations, we are providing the following:

- a short definition of each term;
- an example from a specific student expectation for this subject area; and
- a short explanation of how this term affects this student expectation.

Such as

The term *such as* is used when the specific examples that follow it function only as representative illustrations that help define the expectation for teachers. These examples are just that—examples. Teachers may choose to use them when teaching the student expectation, but there is no requirement to use them. Other examples can be used in addition to those listed or as replacements for those listed.

Example from Objective 8

(G.11)(C) [develop,] apply, and justify triangle similarity relationships, such as right triangle ratios, [trigonometric ratios,] and Pythagorean triples using a variety of methods.

This student expectation lists *relationships, such as right triangle ratios, [trigonometric ratios,] and Pythagorean triples.* Many other relationships exist to help students understand similarity.

Including

The term *including* is used when the specific examples that follow it must be taught. However, other examples may also be used in conjunction with those listed.

Example from Objective 6

(G.5)(B) use numeric and geometric patterns to make generalizations about geometric properties, including properties of polygons, ratios in similar figures and solids, and angle relationships in polygons and circles.

This student expectation lists several geometric properties students should know. There are other properties that may be taught.

Remember

- Any example preceded by the term *such as* in a particular student expectation may or may not provide the basis for an item assessing that expectation. Because these examples do not necessarily have to be used to teach the student expectation, it is equally likely that other examples may be used in assessment items. The rule here is that an example will be used only if it is central to the knowledge, concept, or skill the item assesses.
- It is more likely that some of the examples preceded by the term *including* in a particular student expectation will provide the basis for items assessing that expectation, since these examples must be taught. However, it is important to remember that the examples that follow the term *including* do not represent all the examples possible, so other examples may also provide the basis for an assessment item. Again, the rule here is that an example will be used only if it is central to the knowledge, concept, or skill the item assesses.

Exit Level TAKS Mathematics—Objective 1

Understanding **functional relationships** is critical for algebra and geometry. Students need to understand that functions represent ordered pairs of numbers in which the value of one number is dependent on the value of the other. This basic idea has major significance in areas such as science, social studies, and economics. From their understanding of functions, students should be able to communicate information using models, tables, graphs, diagrams, verbal descriptions, and algebraic equations or inequalities. Making inferences and drawing conclusions from functional relationships are also important skills for students because these skills will allow students to understand how functions relate to real-life situations and how real-life situations relate to functions. Mastering the knowledge and skills in Objective 1 at the exit level will help students master the knowledge and skills in other TAKS objectives at the exit level.

Objective 1 groups together the basic ideas of **functional relationships** included within the TEKS. The concepts of **patterns, relationships, and algebraic thinking** found in the lower grades form the foundation for Objective 1.

TAKS Objectives and TEKS Student Expectations

Objective 1

The student will describe functional relationships in a variety of ways.

(A.1) **Foundations for functions.** The student understands that a function represents a dependence of one quantity on another and can be described in a variety of ways. The student is expected to

(A) describe independent and dependent quantities in functional relationships;

(B) [gather and record data and] use data sets to determine functional relationships between quantities;

(C) describe functional relationships for given problem situations and write equations or inequalities to answer questions arising from the situations;

(D) represent relationships among quantities using [concrete] models, tables, graphs, diagrams, verbal descriptions, equations, and inequalities; and

(E) interpret and make decisions, predictions, and critical judgments from functional relationships.

Objective 1—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 1. For the exit level test, students should be able to

- work with linear and quadratic functions;
- describe a functional relationship by selecting an equation or inequality that describes one variable in terms of another variable;
- match a representation of a functional relationship with an interpretation of the results for a given situation;
- translate functional relationships among numerous forms; and
- work with linear equations in different forms, such as slope-intercept, standard, etc.

Objective 1 Sample Items

1 If y is a function of x in the equation $y = 2x - 7$, which statement is true?

A The independent variable, y, is equal to 7 less than twice the dependent variable, x.

B* The dependent variable, y, is equal to 7 less than twice the independent variable, x.

C The independent variable, y, is equal to twice the difference between the dependent variable, x, and 7.

D The dependent variable, y, is equal to twice the difference between the independent variable, x, and 7.

2 The area of a triangular flag is 35 square feet. If the base of the flag is 5 feet less than its height, which equation can be used to determine h, the height of this triangular flag in feet?

A* $h^2 - 5h = 70$

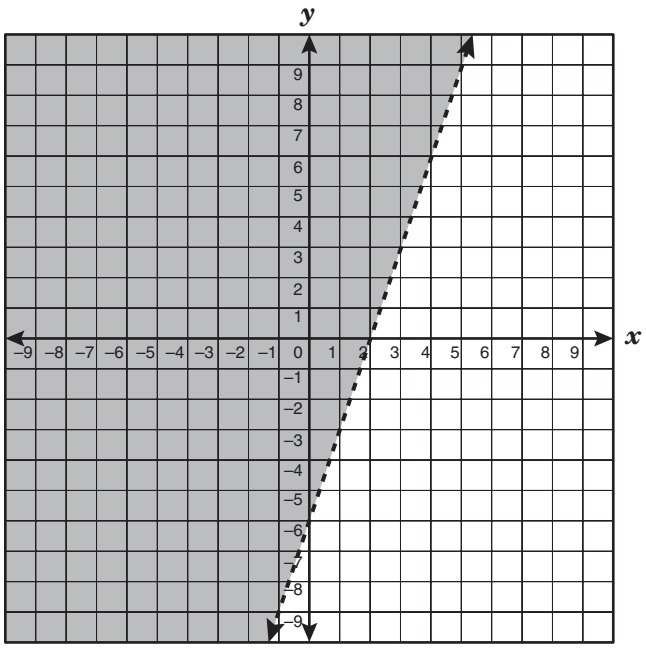
B $5h - h^2 = 35$

C $5h - h^2 = 70$

D $h^2 - 5h = 35$

Objective 1 Sample Items

3 Identify the inequality that best represents the graph shown below.



A $3x - y > 6$

B* $6x - 2y < 12$

C $3x - y < -6$

D $6x - 2y > -12$

Exit Level TAKS Mathematics—Objective 2

Understanding the **properties and attributes of functions** is critical for algebra and geometry. Recognizing the similarities and differences between linear and quadratic functions is useful when evaluating and analyzing statistical data. The ability to work with and solve algebraic equations is useful for creating effective personal and business budgets that include shopping, fuel efficiency, car payments, etc. Mastering the knowledge and skills in Objective 2 at the exit level will help students master the knowledge and skills in other TAKS objectives at the exit level.

Objective 2 groups together the **properties and attributes of functions** found within the TEKS. The concepts of **patterns, relationships, and algebraic thinking** found in the lower grades form the foundation for Objective 2.

TAKS Objectives and TEKS Student Expectations

Objective 2

The student will demonstrate an understanding of the properties and attributes of functions.

(A.2) **Foundations for functions.** The student uses the properties and attributes of functions. The student is expected to

- (A) identify [and sketch] the general forms of linear ($y = x$) and quadratic ($y = x^2$) parent functions;
- (B) identify mathematical domains and ranges and determine reasonable domain and range values for given situations, both continuous and discrete;
- (C) interpret situations in terms of given graphs [or create situations that fit given graphs]; and
- (D) [collect and] organize data, [make and] interpret scatterplots (including recognizing positive, negative, or no correlation for data approximating linear situations), and model, predict, and make decisions and critical judgments in problem situations.

(A.3) **Foundations for functions.** The student understands how algebra can be used to express generalizations and recognizes and uses the power of symbols to represent situations. The student is expected to

- (A) use symbols to represent unknowns and variables; and
- (B) look for patterns and represent generalizations algebraically.

(A.4) **Foundations for functions.** The student understands the importance of the skills required to manipulate symbols in order to solve problems and uses the necessary algebraic skills required to simplify algebraic expressions and solve equations and inequalities in problem situations. The student is expected to

(A) find specific function values, simplify polynomial expressions, transform and solve equations, and factor as necessary in problem situations;

(B) use the commutative, associative, and distributive properties to simplify algebraic expressions; and

(C) connect equation notation with function notation, such as $y = x + 1$ and $f(x) = x + 1$.

Objective 2—For Your Information

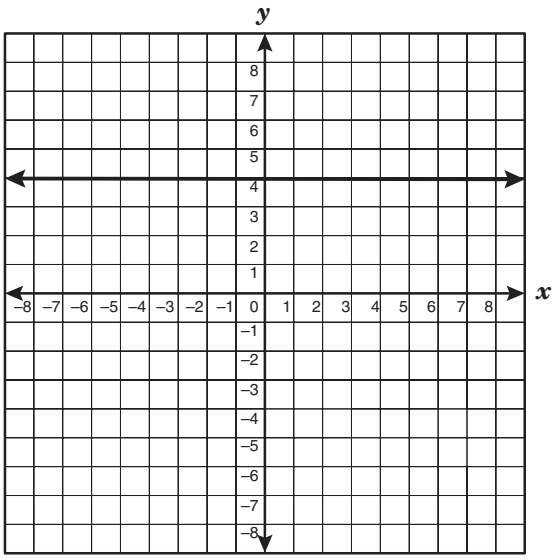
The following list provides additional information for some of the student expectations tested in Objective 2. For the exit level test, students should be able to

- work with linear and quadratic functions;
- identify a valid decision or judgment based on a given set of data;
- write an expression or equation describing a pattern; and
- work with linear equations in different forms, such as slope-intercept, standard, etc.

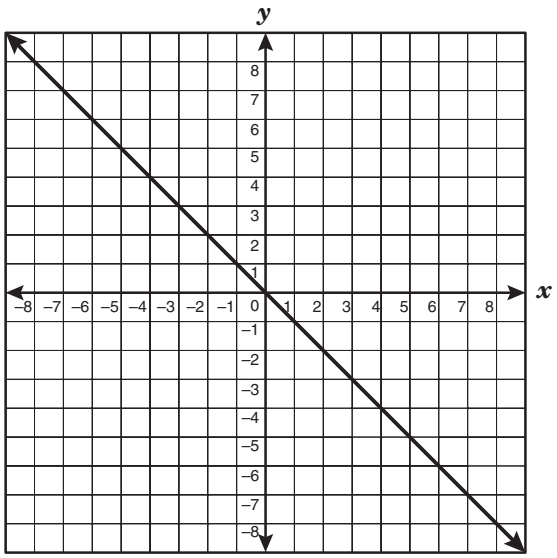
Objective 2 Sample Items

1 Which graph below best represents the parent function of $y = -\frac{1}{3}x + 4$?

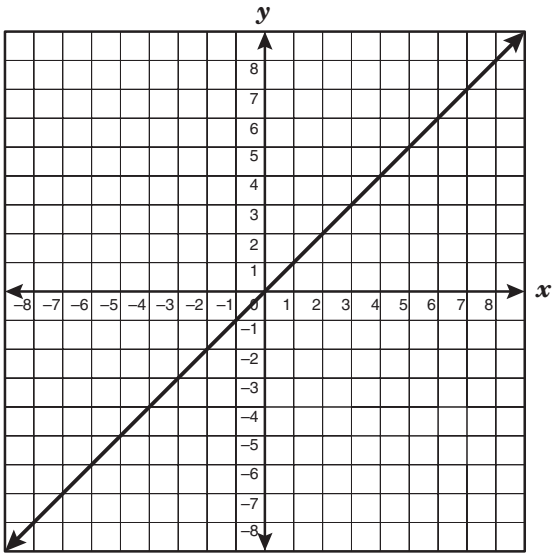
A



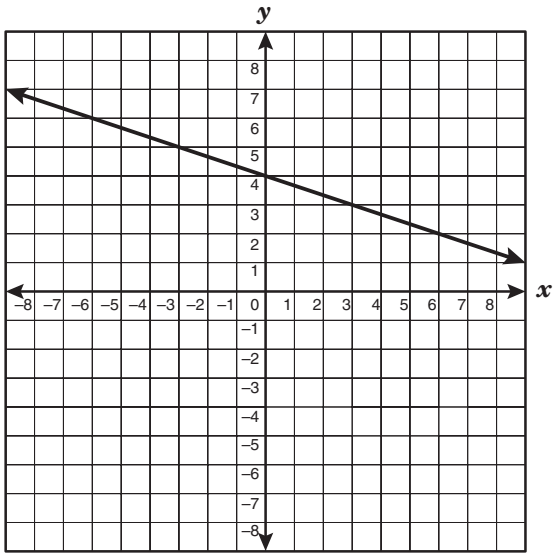
C



B*



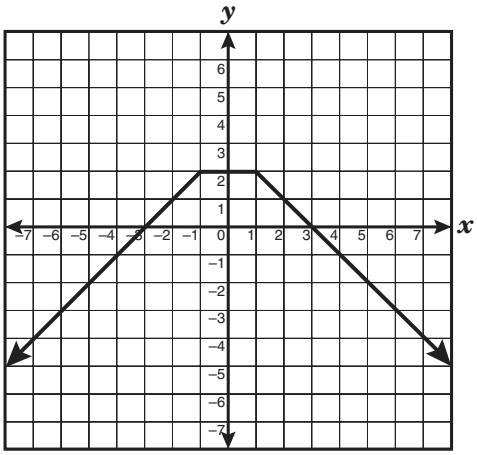
D



Note: Students must be able to distinguish between the graph of an equation and the graph of its parent function.

Objective 2 Sample Items

2 Which best describes the range represented in the graph?



A $-3 \leq y \leq 3$

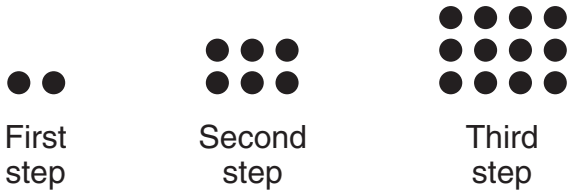
B $-3 \leq x \leq 3$

C $x \leq 2$

D* $y \leq 2$

Note: Students must be able to distinguish between the domain and the range of a function.

3 The pattern of dots shown below continues infinitely, with more dots being added at each step.



Which expression can be used to determine the number of dots in the nth step?

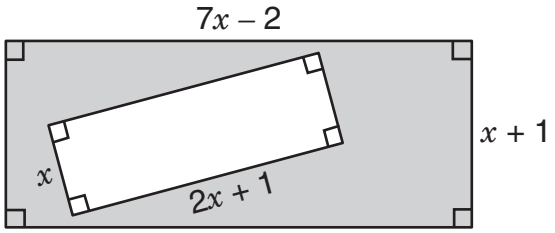
A $2n$

B $n(n + 2)$

C* $n(n + 1)$

D $2(n + 1)$

4 Which of the following expressions is equal to the area of the shaded region in square units in the diagram shown below?



A* $5x^2 + 4x - 2$

B $5x^2 + 6x - 2$

C $9x^2 + 6x - 2$

D $7x^2 + 5x - 2$

Exit Level TAKS Mathematics—Objective 3

Understanding **linear functions** is critical for algebra and geometry. Students should understand that linear functions are relationships that exhibit a constant rate of change and can be represented by the graph of a line. Linear functions are an integral part of science, geography, and economics. The concept of rate of change between data points is used in everyday situations such as calculating taxicab or telephone-billing rates. Mastering the knowledge and skills in Objective 3 at the exit level will help students master the knowledge and skills in other TAKS objectives at the exit level.

Objective 3 groups together concepts of **linear functions** found within the TEKS. The concepts of **patterns, relationships, and algebraic thinking** found in the lower grades form the foundation for Objective 3.

TAKS Objectives and TEKS Student Expectations

Objective 3

The student will demonstrate an understanding of linear functions.

(A.5) **Linear functions.** The student understands that linear functions can be represented in different ways and translates among their various representations. The student is expected to

- (A) determine whether or not given situations can be represented by linear functions; and
- (C) use, translate, and make connections among algebraic, tabular, graphical, or verbal descriptions of linear functions.

(A.6) **Linear functions.** The student understands the meaning of the slope and intercepts of the graphs of linear functions and zeros of linear functions and interprets and describes the effects of changes in parameters of linear functions in real-world and mathematical situations. The student is expected to

- (A) develop the concept of slope as rate of change and determine slopes from graphs, tables, and algebraic representations;
- (B) interpret the meaning of slope and intercepts in situations using data, symbolic representations, or graphs;
- (C) investigate, describe, and predict the effects of changes in m and b on the graph of $y = mx + b$;
- (D) graph and write equations of lines given characteristics such as two points, a point and a slope, or a slope and y-intercept;
- (E) determine the intercepts of the graphs of linear functions and zeros of linear functions from graphs, tables, and algebraic representations;

(F) interpret and predict the effects of changing slope and *y*-intercept in applied situations; and

(G) relate direct variation to linear functions and solve problems involving proportional change.

Objective 3—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 3. For the exit level test, students should be able to

- translate linear relationships among various forms;
- work with linear equations in different forms, such as slope-intercept, standard, etc.; and
- work with both *x*- and *y*-intercepts.

Objective 3 Sample Items

1 Which of the following describes a linear function?

A Finding the amount of cement needed for a driveway with a rectangular surface that measures $2x$ meters long, x meters wide, and x centimeters thick

B* Finding the final cost of an item that originally sold for x dollars but is marked down 40% and has an $8\frac{1}{4}\%$ tax rate

C Finding the cost of buying carpet for a rectangular room $(x + 5)$ feet long and x feet wide at \$19.95 per square foot

D Finding the cost of painting a circular tile with a radius of x feet with paint that costs \$12 per gallon

2 The cost of a long-distance telephone call is a function of the length of the call. The cost of 4 calls is shown in the table.

Minutes	Cost
5	\$0.60
15	\$1.80
25	\$3.00
60	\$7.20

If the data are graphed with minutes on the horizontal axis and cost on the vertical axis, what does the slope represent?

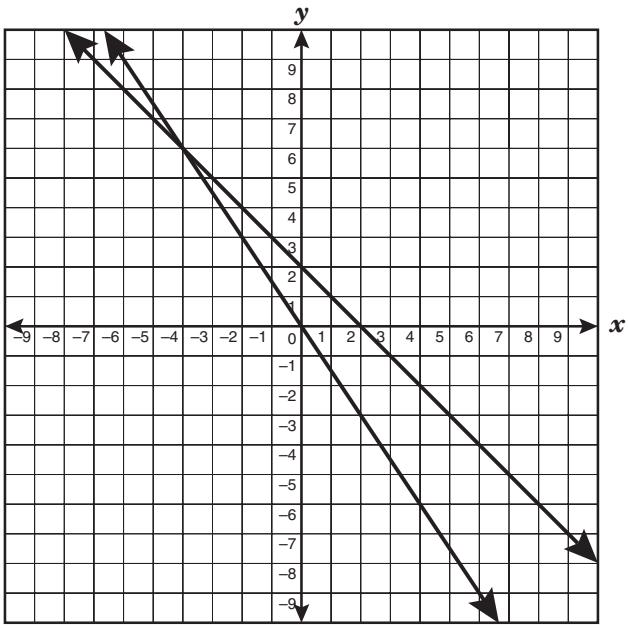
A* A rate of \$0.12 per minute

B The total cost per call

C An average time of $8\frac{1}{3}$ minutes per call

D A total time of 10 minutes between calls

3 Two lines are shown on the grid. The two lines pass through $(-4, 6)$. One line passes through the origin, and the other passes through the point $(5, -3)$.



Which pair of equations below identifies these lines?

A $y = -x + 2$ and $y = \frac{1}{2}x - \frac{3}{2}$

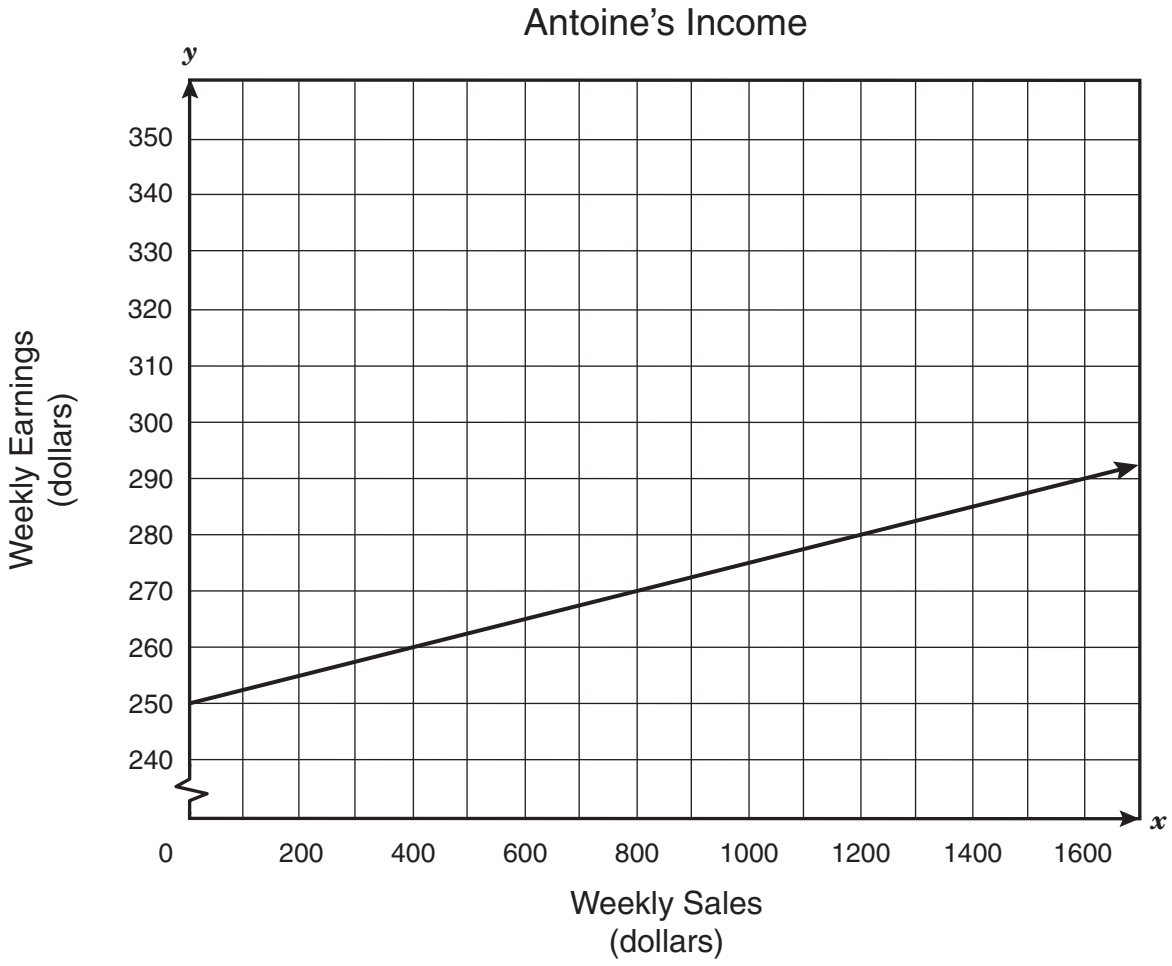
B $y = \frac{1}{2}x$ and $y = x - 2$

C $y = -\frac{1}{2}x$ and $y = -\frac{2}{3}x$

D* $y = -x + 2$ and $y = -\frac{3}{2}x$

Objective 3 Sample Items

4 As a part-time employee at Electronic Bionic, Antoine earns a weekly base salary plus a 2.5% commission on his total weekly sales. The graph below shows what Antoine's weekly earnings could be, depending on his weekly sales.



When Antoine becomes a full-time employee at Electronic Bionic, his weekly base salary will increase by $25, and he will earn a 4.5% commission on his total weekly sales. How much greater will Antoine's weekly earnings be as a full-time employee when his weekly sales are $1600?

A $290

B* $57

C $32

D $347

Exit Level TAKS Mathematics—Objective 4

Understanding how to **formulate and use linear equations and inequalities** is critical for algebra and geometry. The ability to organize contextual problems into equations and inequalities or systems of equations allows students to find and evaluate reasonable solutions in daily situations. For example, as students become more knowledgeable consumers, they may want to use a system of equations to determine which car-insurance company offers a better rate. Mastering the knowledge and skills in Objective 4 at the exit level will help students master the knowledge and skills in other TAKS objectives at the exit level.

Objective 4 groups together the ideas of how to **formulate and use linear equations and inequalities** found within the TEKS. The concepts of **patterns, relationships, and algebraic thinking** found in the lower grades form the foundation for Objective 4.

TAKS Objectives and TEKS Student Expectations

Objective 4

The student will formulate and use linear equations and inequalities.

(A.7) **Linear functions.** The student formulates equations and inequalities based on linear functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation. The student is expected to

- (A) analyze situations involving linear functions and formulate linear equations or inequalities to solve problems;
- (B) investigate methods for solving linear equations and inequalities using [concrete] models, graphs, and the properties of equality, select a method, and solve the equations and inequalities; and
- (C) interpret and determine the reasonableness of solutions to linear equations and inequalities.

(A.8) **Linear functions.** The student formulates systems of linear equations from problem situations, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation. The student is expected to

- (A) analyze situations and formulate systems of linear equations in two unknowns to solve problems;
- (B) solve systems of linear equations using [concrete] models, graphs, tables, and algebraic methods; and
- (C) interpret and determine the reasonableness of solutions to systems of linear equations.

Objective 4—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 4. For the exit level test, students should be able to

- work with linear equations in different forms, such as slope-intercept, standard, etc.;
- select an equation or inequality that can be used to find the solution;
- find a solution expressed as a number or a range of numbers; and
- evaluate a solution in terms of a given context and determine whether the solution is reasonable.

Objective 4 Sample Items

1 Barry purchased a box for fishing tackle that cost \$19 and x fishing hooks that cost \$0.26 each. If a sales tax of 7.75% is applied to the total purchase, which equation can be used to find y, the total cost of the tackle box and the fishing hooks?

A* $y = (19 + 0.26x) + (19 + 0.26x)(0.0775)$

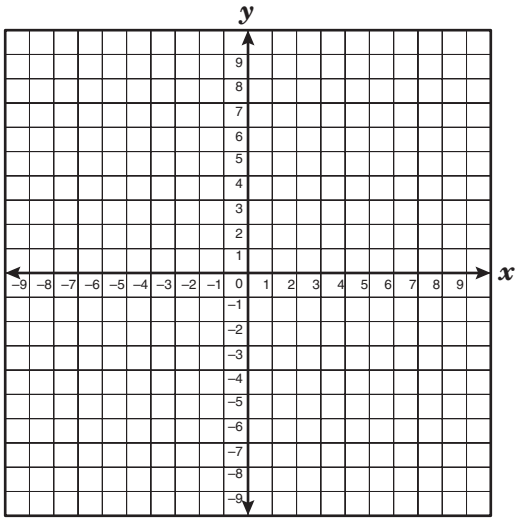
B $y = 19 + 0.26x + 19(0.775)$

C $y = (19 + 0.26x)(0.0775)$

D $y = (19 + 0.26x)(19 + 0.26x)(0.0775)$

Note: Students should recognize that the answer could be written as $y = (19 + 0.26x)(1.0775)$.

2 Which of the following ordered pairs is in the solution set of $y < -\frac{1}{6}x + 4$?



A (0, 4)

B (6, 3)

C (−7, 8)

D* (−5, 1)

Note: Students may solve this problem in multiple ways. In this situation, the student could use the blank grid to graph the inequality.

Objective 4 Sample Items

3 The owners of a new restaurant want to spend no more than $1000 for at least 10 minutes of advertising. The cost to advertise on a local television station is $200 per minute. The cost to advertise on a local radio station is $50 per minute. If the owners of the restaurant want to get the maximum number of minutes of exposure for $1000 in advertising both on television and radio, which of the following is a reasonable solution?

A The owners can advertise 12 minutes on television and 2 minutes on radio.

B* The owners can advertise 3 minutes on television and 8 minutes on radio.

C The owners can advertise 4 minutes on television and 4 minutes on radio.

D The owners can advertise 1 minute on television and 18 minutes on radio.

4 The Hurston High School track team needs 25 team shirts with both the school mascot and the letters HHS on them. Each shirt with a printed mascot costs $9.95. The letters HHS cost $0.75 per letter. A supplier will sell every fifth shirt with the school's mascot and letters for half price. What is a reasonable conclusion about p, the total price of all 25 shirts before taxes?

A $\$200 < p \leq \$250$

B* $\$250 < p \leq \$300$

C $\$300 < p \leq \$350$

D $\$350 < p \leq \$400$

Exit Level TAKS Mathematics—Objective 5

Understanding **quadratic and other nonlinear functions** is critical for algebra and geometry. Students should understand that quadratic functions can be represented by the graph of a parabola. Graphs of quadratic functions can be used to represent data, such as projectile motion in physics, wind chill predictions in meteorology, and profit margins in economics. In these and other examples, students should understand how changes in the functional situation affect the graph of the parabola. Understanding the correct use of exponents is essential in scientific fields, such as medicine, astronomy, and microbiology. Mastering the knowledge and skills in Objective 5 at the exit level will help students master the knowledge and skills in other TAKS objectives at the exit level.

Objective 5 groups together the concepts of **quadratic and other nonlinear functions** found within the TEKS. The concepts of **patterns, relationships, and algebraic thinking** found in the lower grades form the foundation for Objective 5.

TAKS Objectives and TEKS Student Expectations

Objective 5

The student will demonstrate an understanding of quadratic and other nonlinear functions.

(A.9) **Quadratic and other nonlinear functions.** The student understands that the graphs of quadratic functions are affected by the parameters of the function and can interpret and describe the effects of changes in the parameters of quadratic functions. The student is expected to

(B) investigate, describe, and predict the effects of changes in a on the graph of $y = ax^2 + c$;

(C) investigate, describe, and predict the effects of changes in c on the graph of $y = ax^2 + c$; and

(D) analyze graphs of quadratic functions and draw conclusions.

(A.10) **Quadratic and other nonlinear functions.** The student understands there is more than one way to solve a quadratic equation and solves them using appropriate methods. The student is expected to

(A) solve quadratic equations using [concrete] models, tables, graphs, and algebraic methods; and

(B) make connections among the solutions (roots) of quadratic equations, the zeros of their related functions, and the horizontal intercepts (x-intercepts) of the graph of the function.

(A.11) **Quadratic and other nonlinear functions.** The student understands there are situations modeled by functions that are neither linear nor quadratic and models the situations. The student is expected to

(A) use [patterns to generate] the laws of exponents and apply them in problem-solving situations.

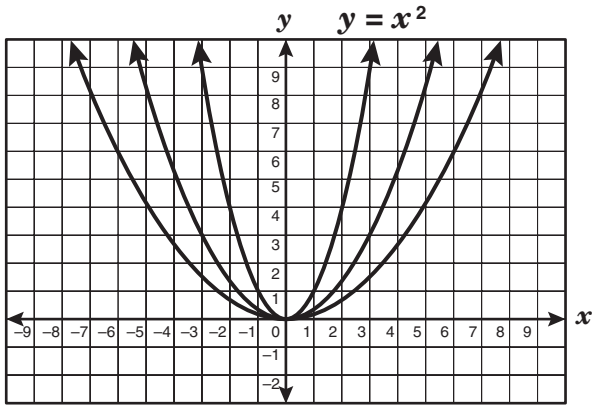
Objective 5—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 5. For the exit level test, students should be able to

- recognize how the graph of the parabola is modified when the quadratic equation changes; and
- determine reasonable solutions to quadratic equations based on the given context of the problem.

Objective 5 Sample Items

1 The grid below shows the graphs of 3 different quadratic functions of the form $y = ax^2$.



Given the graph of $y = x^2$ as shown, which of the following inequalities best describes the value of a for the other two graphs?

A $a > 1$

B $a < 0$

C $0 \leq a \leq 1$

D* $0 < a < 1$

2 The table below shows values for a particular quadratic equation.

x	y
−1	15.5
0	5.5
1	−0.5
2	−2.5
3	−0.5
4	5.5
5	15.5

According to the table, between which two integers can a root to this equation be found?

A* 3 and 4

B 1 and 2

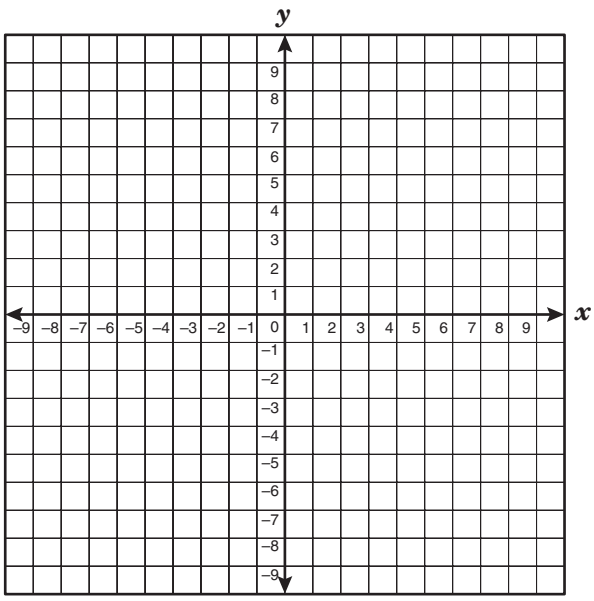
C −1 and 0

D 2 and 3

Note: Students should recognize that the roots of the equation are the same as the x-value of the x-intercepts.

Objective 5 Sample Items

3 The vertex of the graph of a quadratic function is $(-1, 9)$. What are the zeros of this function if the point $(2, 0)$ lies on the graph?



A $x = -2$ and $x = 4$

B* $x = -4$ and $x = 2$

C $x = 2$ and $x = 0$

D Cannot be determined

4 Which expression best describes the volume of a rectangular prism that has a height of $5x^4$ units and a square base with side lengths of $3x^4$ units?

A $15x^8$ units^3

B $30x^8$ units^3

C* $45x^{12}$ units^3

D $11x^{12}$ units^3

Exit Level TAKS Mathematics—Objective 6

Understanding **geometric relationships and spatial reasoning** is important because the structure of the world is based on geometric properties. The concepts covered in this objective are an integral part of many fields, such as physics, navigation, geography, and construction. These concepts build spatial-reasoning skills that help develop an understanding of distance and location. The knowledge and skills contained in Objective 6 will allow students to understand how the basic concepts of geometry are related to the real world. Mastering the knowledge and skills in Objective 6 at the exit level will help students master the knowledge and skills in other TAKS objectives at the exit level.

Objective 6 groups together the fundamental concepts of **geometric relationships and spatial reasoning** found within the TEKS. The concepts of **geometry and spatial reasoning** found in the lower grades form the foundation for Objective 6.

TAKS Objectives and TEKS Student Expectations

Objective 6

The student will demonstrate an understanding of geometric relationships and spatial reasoning.

(G.4) **Geometric structure.** The student uses a variety of representations to describe geometric relationships and solve problems. The student is expected to

(A) select an appropriate representation ([concrete,] pictorial, graphical, verbal, or symbolic) in order to solve problems.

(G.5) **Geometric patterns.** The student uses a variety of representations to describe geometric relationships and solve problems. The student is expected to

(A) use numeric and geometric patterns to develop algebraic expressions representing geometric properties;

(B) use numeric and geometric patterns to make generalizations about geometric properties, including properties of polygons, ratios in similar figures and solids, and angle relationships in polygons and circles;

(C) use properties of transformations and their compositions to make connections between mathematics and the real world, such as tessellations; and

(D) identify and apply patterns from right triangles to solve meaningful problems, including special right triangles (45-45-90 and 30-60-90) and triangles whose sides are Pythagorean triples.

(G.10) **Congruence and the geometry of size.** The student applies the concept of congruence to justify properties of figures and solve problems. The student is expected to

(A) use congruence transformations to make conjectures and justify properties of geometric figures including figures represented on a coordinate plane.

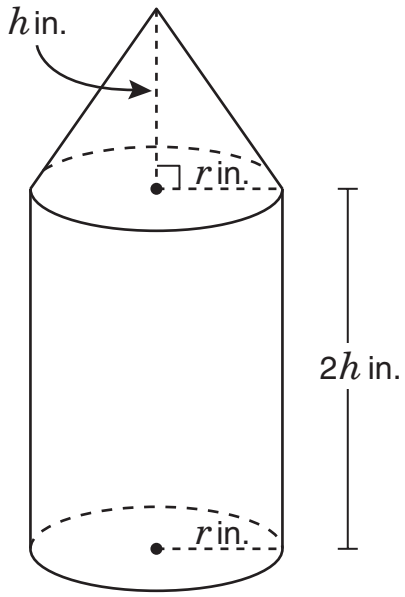
Objective 6—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 6. For the exit level test, students should be able to

- use geometric concepts, properties, theorems, and definitions to solve problems; and
- solve problems by using the rules for special right triangles.

Objective 6 Sample Items

1 The 3-dimensional figure shown below is formed by placing a cone on top of a cylinder.



Which equation best represents V, the volume in cubic inches of this 3-dimensional figure?

A $V = \frac{2}{3}\pi r^2 h$

B $V = \frac{13}{3}\pi r^2 h$

C* $V = \frac{7}{3}\pi r^2 h$

D $V = \frac{5}{3}\pi r^2 h$

Objective 6 Sample Items

2 Which statement describes regular polygons that can tessellate by themselves?

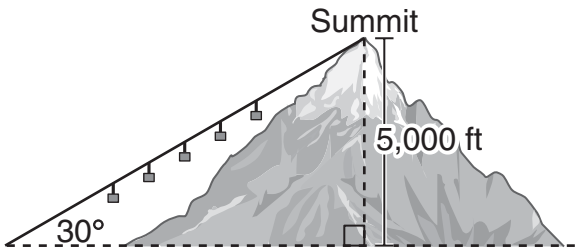
A The number of sides of a regular polygon that tessellates by itself is a factor of 3.

B* Each interior angle of a regular polygon that tessellates by itself is a factor of 360°.

C The number of sides of a regular polygon that tessellates by itself is a factor of 4.

D Each interior angle of a regular polygon that tessellates by itself is a factor of 180°.

3 The cable cars of a ski lift rise 5,000 vertical feet from the base at a constant 30° angle of inclination.



What is the approximate straight-line distance that a cable car travels from the base to the summit of the mountain?

A 2,500 ft

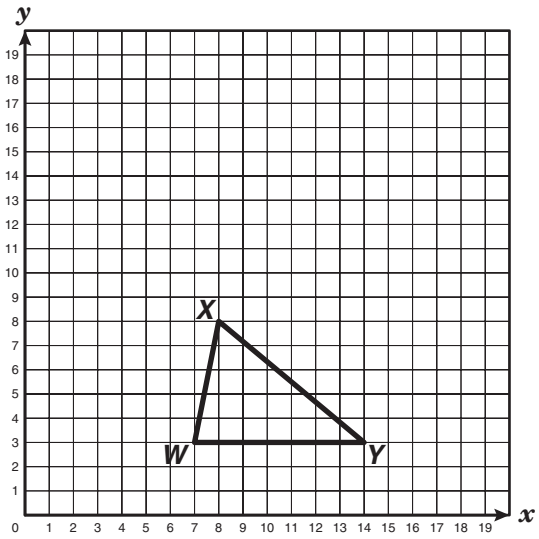
B 2,900 ft

C 8,500 ft

D* 10,000 ft

Objective 6 Sample Items

4 ΔWXY is graphed on the coordinate grid below.



Which set of coordinates represents the vertices of a triangle congruent to ΔWXY?

A (2, 6), (2, 12), (7, 11)

B* (2, 6), (2, 13), (7, 12)

C (3, 8), (3, 13), (8, 12)

D (3, 8), (3, 14), (8, 11)

Exit Level TAKS Mathematics—Objective 7

Understanding **two- and three-dimensional representations of geometric relationships and shapes** is important because the structure of the world is based on geometric properties. The concepts covered in this objective are an integral part of many fields, such as molecular chemistry, aviation, pattern design, etc. These concepts build spatial-reasoning skills that help develop an understanding of distance, location, area, and space. The knowledge and skills contained in Objective 7 will allow students to understand how the basic concepts of geometry are related to the real world. Mastering the knowledge and skills in Objective 7 at the exit level will help students master the knowledge and skills in other TAKS objectives at the exit level.

Objective 7 groups together the fundamental concepts of **two- and three-dimensional shapes** found within the TEKS. The concepts of **geometry and spatial reasoning** found in the lower grades form the foundation for Objective 7.

TAKS Objectives and TEKS Student Expectations

Objective 7

The student will demonstrate an understanding of two- and three-dimensional representations of geometric relationships and shapes.

(G.6) **Dimensionality and the geometry of location.** The student analyzes the relationship between three-dimensional geometric figures and related two-dimensional representations and uses these representations to solve problems. The student is expected to

- (B) use nets to represent [and construct] three-dimensional geometric figures; and
- (C) use orthographic and isometric views of three-dimensional geometric figures to represent [and construct] three-dimensional geometric figures and solve problems.

(G.7) **Dimensionality and the geometry of location.** The student understands that coordinate systems provide convenient and efficient ways of representing geometric figures and uses them accordingly. The student is expected to

- (A) use one- and two-dimensional coordinate systems to represent points, lines, rays, line segments, and figures;
- (B) use slopes and equations of lines to investigate geometric relationships, including parallel lines, perpendicular lines, and [special segments of] triangles and other polygons; and
- (C) derive and use formulas involving length, slope, and midpoint.

(G.9) **Congruence and the geometry of size.** The student analyzes properties and describes relationships in geometric figures. The student is expected to

(D) analyze the characteristics of polyhedra and other three-dimensional figures and their component parts based on explorations and [concrete] models.

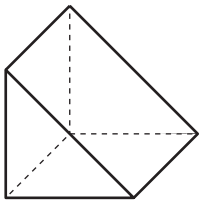
Objective 7—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 7. For the exit level test, students should be able to

- match a two-dimensional representation of a solid with a three-dimensional representation of the same solid, using orthographic (top, side, etc.) views and/or isometric (corner) views of the solid;
- identify and use formal geometric terms; and
- use geometric concepts, properties, theorems, and definitions to solve problems.

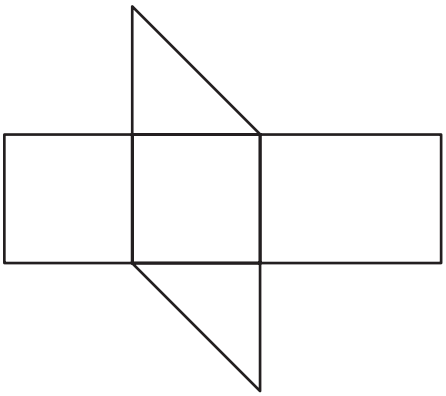
Objective 7 Sample Items

1 Look at the figure shown below.

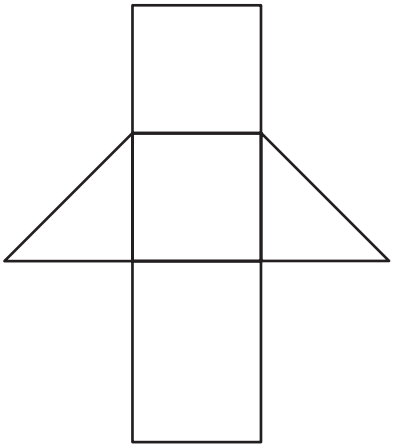


Which net best represents this figure?

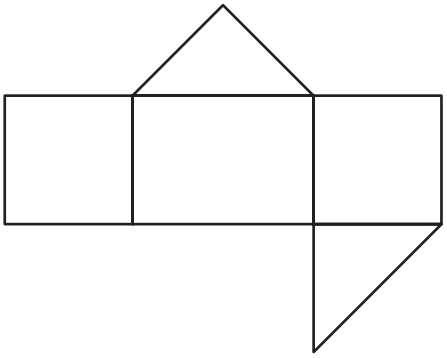
A



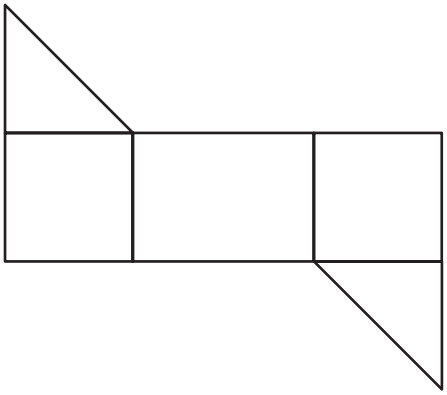
C



B



D*



Objective 7 Sample Items

2 Points R, S, and T are collinear, and point S is between points R and T. The coordinate for point R is 20. If $RT = 24$ units and $ST = 2RS$ units, what is a coordinate for point S?

A 44

B* 28

C 36

D 22

3 Which of the following best describes the graphs of the equations shown below?

$$3y = -4x - 16$$
$$8y = 6x + 13$$

A The lines intersect but are not perpendicular.

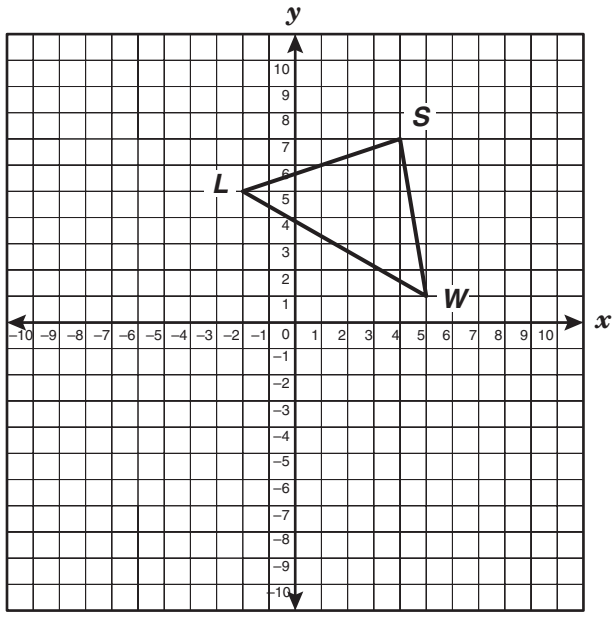
B The lines are the same.

C* The lines are perpendicular.

D The lines are parallel.

Objective 7 Sample Items

4 ΔLSW, which has vertices L $(-2, 5)$, S $(4, 7)$, and W $(5, 1)$, is graphed on the grid below.



If $\overline{ST}$ is a median of ΔLSW, which is closest to the length of $\overline{ST}$?

A 8 units

B 4 units

C 7 units

D* 5 units

Exit Level TAKS Mathematics—Objective 8

Understanding the **concepts and uses of measurement and similarity** has many real-world applications and provides a basis for developing skills in geometry and in other academic disciplines. The concept of surface area is essential in everyday tasks such as laying carpet, upholstering furniture, painting houses, etc. Businesses involved with packing and shipping find the effect of changes in area, perimeter, and volume critical in their work. Understanding the basic concepts included in Objective 8 will prepare students to apply measurement skills in various situations. Mastering the knowledge and skills found in Objective 8 at the exit level will help students master the knowledge and skills found in other TAKS objectives at the exit level.

Objective 8 groups together the **concepts and uses of measurement and similarity** found within the TEKS. The **concepts and uses of measurement** found in the lower grades form the foundation for Objective 8.

TAKS Objectives and TEKS Student Expectations

Objective 8

The student will demonstrate an understanding of the concepts and uses of measurement and similarity.

(G.8) **Congruence and the geometry of size.** The student uses tools to determine measurements of geometric figures and extends measurement concepts to find perimeter, area, and volume in problem situations. The student is expected to

- (A) find areas of regular polygons, circles, and composite figures;
- (B) find areas of sectors and arc lengths of circles using proportional reasoning;
- (C) [derive,] extend, and use the Pythagorean Theorem; and
- (D) find surface areas and volumes of prisms, pyramids, spheres, cones, cylinders, and composites of these figures in problem situations.

(G.11) **Similarity and the geometry of shape.** The student applies the concepts of similarity to justify properties of figures and solve problems. The student is expected to

- (A) use and extend similarity properties and transformations to explore and justify conjectures about geometric figures;
- (B) use ratios to solve problems involving similar figures;

(C) [develop,] apply, and justify triangle similarity relationships, such as right triangle ratios, [trigonometric ratios,] and Pythagorean triples using a variety of methods; and

(D) describe the effect on perimeter, area, and volume when one or more dimensions of a figure are changed and apply this idea in solving problems.

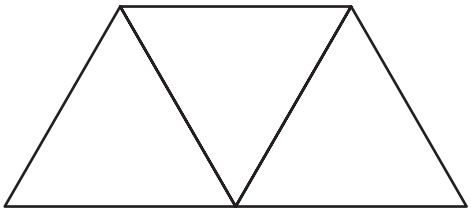
Objective 8—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 8. For the exit level test, students should be able to

- utilize the conversions and formulas on the Mathematics Chart to solve problems;
- measure with the ruler on the Mathematics Chart ***only if*** the item specifically instructs students to use the ruler;
- use the given dimensions of a figure to solve a problem;
- recognize abbreviations of measurement units;
- find and apply scale factors in problem-solving situations;
- describe, in the form of a verbal or algebraic expression or mathematical solution, the effect on perimeter, area, or volume when any dimension of a figure is changed (for example, if the sides of a rectangle are doubled in length, then the perimeter is doubled, and the area is four times the original area; if the edges of a cube are doubled in length, then the volume is eight times the original volume); and
- use geometric concepts, properties, theorems, formulas, and definitions to solve problems.

Objective 8 Sample Items

1 The isosceles trapezoid shown below is formed from three congruent equilateral triangles.



If the length of a side of an equilateral triangle is 8 units, which is closest to the area of the entire isosceles trapezoid?

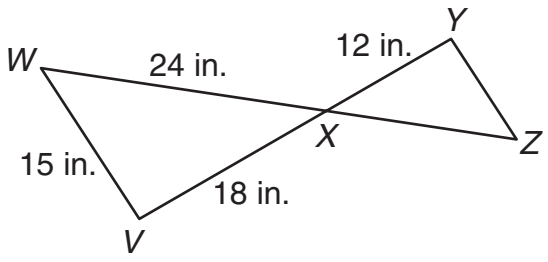
A 96 units ^{2}

B 42 units ^{2}

C* 83 units ^{2}

D 28 units ^{2}

2 In the figures shown below, ΔWVX and ΔZYX are similar.



What is the perimeter of ΔZYX?

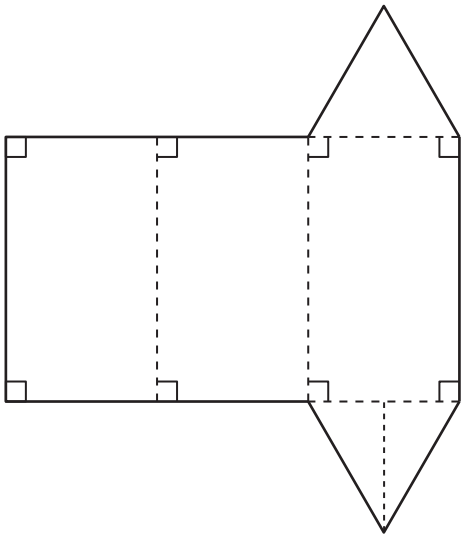
A 28.5 inches

B 39 inches

C 21 inches

D* 38 inches

3 The figure below is a net of a candy box in the shape of a triangular prism. Use the ruler on the Mathematics Chart to measure the dimensions of the net to the nearest tenth of a centimeter.



Which measurement best approximates the volume of the triangular prism represented by the net?

A* 6.1 cm ^{3}

B 11.9 cm ^{3}

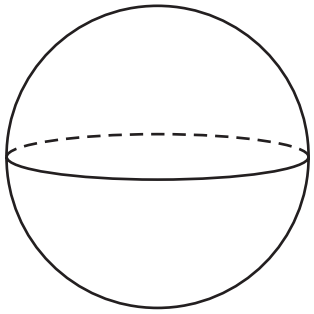
C 23.0 cm ^{3}

D 35.7 cm ^{3}

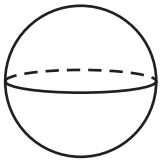
Note: This item specifically instructs students to measure the dimensions of the net to the nearest tenth of a centimeter. Students need to use the correct ruler on the Mathematics Chart based on the unit of measure stated in the problem.

Objective 8 Sample Items

4 The radius of the larger sphere shown below was multiplied by a factor of $\frac{1}{2}$ to produce the smaller sphere.



Radius = r



Radius = $\frac{1}{2}r$

How does the surface area of the smaller sphere compare to the surface area of the larger sphere?

A The surface area of the smaller sphere is $\frac{1}{2}$ as large.

B The surface area of the smaller sphere is $\frac{1}{\pi}$ as large.

C* The surface area of the smaller sphere is $\frac{1}{4}$ as large.

D The surface area of the smaller sphere is $\frac{1}{8}$ as large.

Note: The scale factor is $\frac{1}{2}$. Therefore, the change in area is $\left(\frac{1}{2}\right)^2$, or $\frac{1}{4}$.

Exit Level TAKS Mathematics—Objective 9

Understanding **percents, proportional relationships, probability, and statistics** will help students become informed consumers of data and information. Percent calculations are important in retail, real estate, banking, taxation, etc. As students become more skilled in describing and predicting the results of a probability experiment, they should begin to recognize and account for all the possibilities of a given situation. Students should be able to compare different graphical representations of the same data and solve problems by analyzing the data presented. Students must be able to recognize appropriate and accurate representations of data in everyday situations and in information related to science and social studies (for example, in polls and election results). The knowledge and skills contained in Objective 9 are essential for processing everyday information. Mastering the knowledge and skills in Objective 9 at the exit level will help students master the knowledge and skills in other TAKS objectives at the exit level.

Objective 9 groups together the concepts of **percents, proportional relationships, probability, and statistics** found within the TEKS. The **probability and statistics** found in the lower grades form the foundation for Objective 9.

TAKS Objectives and TEKS Student Expectations

Objective 9

The student will demonstrate an understanding of percents, proportional relationships, probability, and statistics in application problems.

(8.3) **Patterns, relationships, and algebraic thinking.** The student identifies proportional or non-proportional linear relationships in problem situations and solves problems. The student is expected to

(B) estimate and find solutions to application problems involving percents and other proportional relationships, such as similarity and rates.

(8.11) **Probability and statistics.** The student applies concepts of theoretical and experimental probability to make predictions. The student is expected to

(A) find the probabilities of dependent and independent events; and

(B) use theoretical probabilities and experimental results to make predictions and decisions.

(8.12) **Probability and statistics.** The student uses statistical procedures to describe data. The student is expected to

(A) select the appropriate measure of central tendency or range to describe a set of data and justify the choice for a particular situation; and

(C) select and use an appropriate representation for presenting and displaying relationships among collected data, including line plots, line graphs, [stem and leaf plots,] circle graphs, bar graphs, box and whisker plots, histograms, and Venn diagrams, with and without the use of technology.

(8.13) **Probability and statistics.** The student evaluates predictions and conclusions based on statistical data. The student is expected to

(B) recognize misuses of graphical or numerical information and evaluate predictions and conclusions based on data analysis.

Objective 9—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 9. For the exit level test, students should be able to

- distinguish between theoretical probability and experimental results;
- distinguish among mean, median, mode, and range to determine which is most appropriate for a particular purpose;
- identify the missing piece of data that will produce a target mean, median, mode, and/or range for a data set; and
- determine whether the graphical representation of the given data is appropriate and/or accurate.

Objective 9 Sample Items

1 Richard bought a jacket priced at $29.70. The total cost of the jacket, including sales tax, was $32.15. What was the sales tax rate to the nearest hundredth of a percent?

A 2.45%

B 7.62%

C* 8.25%

D 12.12%

2 Mr. Connolly recorded the closing price of a stock each day for a month. Which measure of data did he use to determine that the closing stock price varied by $20.50 during the month?

A Mean

B Median

C Mode

D* Range

3 Jayna has 11 new paperback books. Three of the paperbacks are mysteries, three are science fiction, and the rest are romances. If Jayna were to randomly select two books from this set without replacing them, what is the probability that the first book selected is science fiction and the second book selected is a romance?

A $\frac{15}{121}$

B* $\frac{3}{22}$

C $\frac{9}{110}$

D $\frac{8}{11}$

Note: Students should recognize that in predicting the probability of the second event, there is one less book in the set.

Objective 9 Sample Items

4 Andrea conducted an experiment by rolling a fair cube whose faces were labeled with even numbers. The table below shows the results of her experiment.

Fair-Cube Tosses

Number Landing Face-up	Frequency
2	9
4	12
6	8
8	10
10	12
12	9

What is the difference between the experimental results and the theoretical probability of a 4 or an 8 landing face-up?

A $\frac{19}{60}$

B $\frac{11}{30}$

C* $\frac{1}{30}$

D $\frac{11}{60}$

Note: Students should realize that experimental results may be different than theoretical probability.

Exit Level TAKS Mathematics—Objective 10

Knowledge and understanding of **underlying processes and mathematical tools** are critical for students to be able to apply mathematics in their everyday lives. Problems that occur in the real world often require the use of multiple concepts and skills. Students should be able to recognize mathematics as it occurs in real-life problem situations, generalize from mathematical patterns and sets of examples, select an appropriate approach to solving a problem, solve the problem, and then determine whether the answer is reasonable. Expressing problem situations in mathematical language and symbols is essential to finding solutions to real-life questions. These concepts allow students to communicate clearly and use logical reasoning to make sense of their world. Students can then connect the concepts they have learned in mathematics to other disciplines and to higher mathematics. Through an understanding of the basic ideas found in Objective 10, students will be able to analyze and solve real-world problems. Mastering the knowledge and skills in Objective 10 at the exit level will help students master the knowledge and skills in other TAKS objectives at the exit level.

Objective 10 groups together the **underlying processes and mathematical tools** within the TEKS that are used in finding mathematical solutions to real-world problems. The **underlying processes and mathematical tools** found in the lower grades form the foundation for Objective 10.

TAKS Objectives and TEKS Student Expectations

Objective 10

The student will demonstrate an understanding of the mathematical processes and tools used in problem solving.

(8.14) **Underlying processes and mathematical tools.** The student applies Grade 8 mathematics to solve problems connected to everyday experiences, investigations in other disciplines, and activities in and outside of school. The student is expected to

(A) identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics;

(B) use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness; and

(C) select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem.

(8.15) **Underlying processes and mathematical tools.** The student communicates about Grade 8 mathematics through informal and mathematical language, representations, and models. The student is expected to

(A) communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.

(8.16) **Underlying processes and mathematical tools.** The student uses logical reasoning to make conjectures and verify conclusions. The student is expected to

(A) make conjectures from patterns or sets of examples and nonexamples; and

(B) validate his/her conclusions using mathematical properties and relationships.

Objective 10—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 10. For the exit level test, students should be able to

- select the description of a mathematical situation when provided with a written or pictorial prompt;
- identify the information that is needed to solve a problem;
- select or describe the next step or a missing step in a problem-solving situation;
- match informal language to mathematical language or symbols;
- identify the question that is being asked or answered;
- draw a conclusion by investigating patterns and/or sets of examples and nonexamples. A nonexample, or counterexample, proves a general statement to be false;
- understand that nonsensical words may be used to label sets of examples and/or nonexamples; and
- choose the correct supporting information for a given conclusion.

Objective 10 Sample Items

1 Lenny won a package of carnival tickets at the science fair. He gave a fifth of his tickets to Graciela. Graciela then gave a third of the tickets to Kyle. Kyle gave half of the tickets to Helene. If Helene has 8 tickets, how many carnival tickets did Lenny win?

Record your answer and fill in the bubbles on your answer document. Be sure to use the correct place value.

	2	4	0	.			
⓪	⓪	⓪	●		⓪	⓪	⓪
①	①	①	①		①	①	①
②	●	②	②		②	②	②
③	③	③	③		③	③	③
④	④	●	④		④	④	④
⑤	⑤	⑤	⑤		⑤	⑤	⑤
⑥	⑥	⑥	⑥		⑥	⑥	⑥
⑦	⑦	⑦	⑦		⑦	⑦	⑦
⑧	⑧	⑧	⑧		⑧	⑧	⑧
⑨	⑨	⑨	⑨		⑨	⑨	⑨

Note: The correct answer is 240. It is acceptable, although not necessary, to grid the zeros before the 2 and/or after the decimal. These zeros will not affect the value of the correct answer.

2 Look at the expression shown below.

$$y < z$$

If y and z are both integers less than zero and x is any real number, which statement must be true?

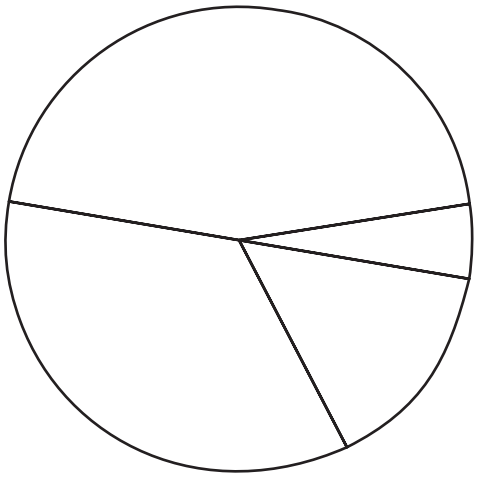
A $y - x > z - x$

B* $x - y > x - z$

C $x - y < x - z$

D $y - x > x - z$

3 The circle graph most accurately represents which of the situations below?



A In the election for class president, Sarah received 40% of the votes, Eddie received 25%, Carol received 15%, and Matthew received 20%.

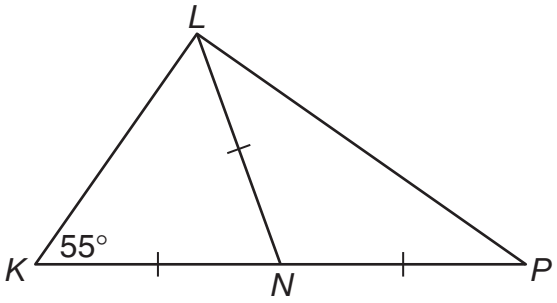
B During a special sale at Calvert Auto Mart, Edward sold 30% of the cars sold, Janet sold 5%, Edith sold 40%, and Mitch sold 25%.

C Mr. and Mrs. Johnson spent 30% of their income on housing, 25% on utilities, 35% on food, and 10% on miscellaneous expenses.

D* In a recent survey about favorite pets, 45% of those surveyed chose dogs, 35% chose cats, 5% chose horses, and 15% chose other animals.

Objective 10 Sample Items

4 In ΔKLP shown below, $\overline{LN}$ intersects $\overline{KP}$ at point N.



Which of the following relationships must be true?

A $m\angle NKL + m\angle NLK = m\angle NPL + m\angle NLP$

B $m\angle KNL = m\angle PNL$

C* $m\angle NPL + m\angle NLP = m\angle KNL$

D $m\angle KNL = m\angle NPL + m\angle LNP$